

Perspectives on monitoring needs for salmon – modeling perspective

Wim Kimmerer
Romberg Tiburon Center for Environmental Studies
San Francisco State University

Randy Brown, DWR (Retired)



Main points

- Key points in the life cycle
- Key population controls
- Important missing information

A general model of salmon survival

$$N_{\text{book}A} = N_{\text{book}0} F S_1 S_2 S_3 S_4 S_5 \dots$$

$N_{\text{book}0, A}$	Female population at age 0 or Adult
F	Average fecundity
S_i	Survival through life stage or event i

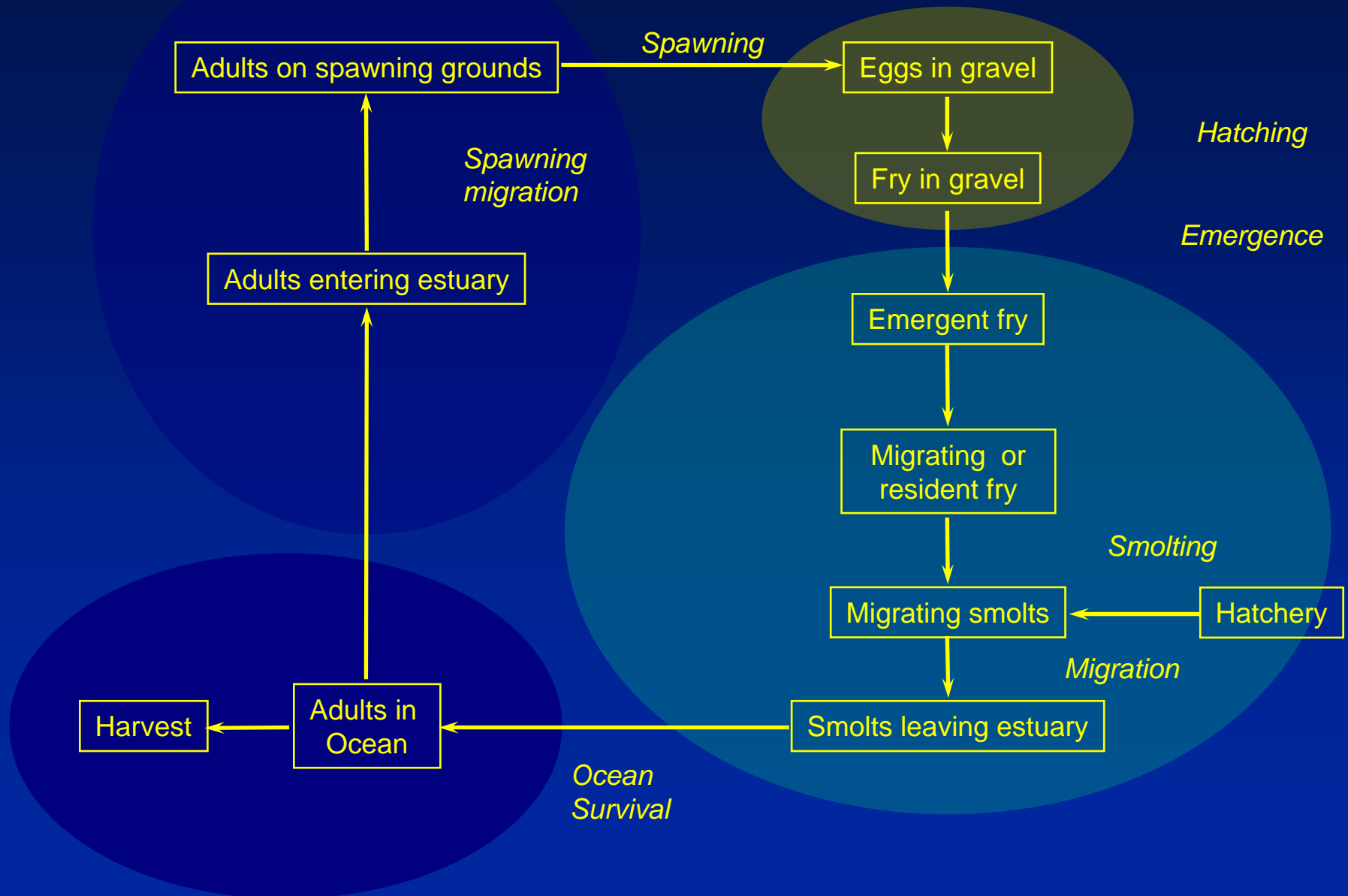
Are any of these density dependent?

Which ones vary the most?

What causes them to vary?

Which are dependent on location?

Key points in the life cycle



Key population controls

- Density dependence (abundant stocks)
 - Superimposition (Battle Creek, American R.)
 - Juvenile rearing habitat: how is it used?
- Temperature effects
- Downstream migration
 - Cues and triggers
 - Rate
 - Survival
- Egg survival
- Adult migration
- Through-Delta survival (esp. San Joaquin)
- Harvest

Important missing information

- **Temperature effects**
 - Survival of eggs
 - Survival and behavior of juveniles
 - Growth and development rate
- **Flow effects**
 - Migration (in and out)
 - Survival
 - Flow-habitat relationships
- **Juvenile survival**
 - Degree of food limitation
- **Survival through Delta**
- **Ocean survival**
 - Effect of ocean conditions
 - Early vs. late survival
- **Effects of hatcheries**
 - Straying
 - Density-dependent harvest

Key foci for monitoring

